

Data-to-Symbol Conversion in Cadiag-4: An Improved Model of Medical Data Interpretation Based on Fuzzy Set Theory

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ABSTRACT

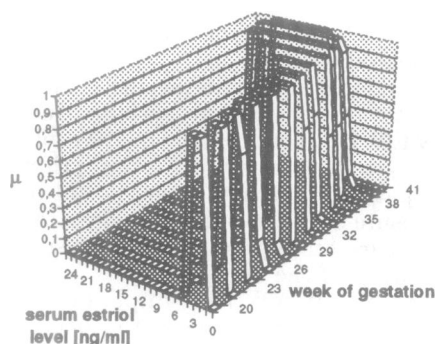
Medical data, which are results of examinations performed on a patient, require an interpretation to allow an assessment of the patient's condition. As a result of this interpretative procedure, medical data are converted into symbolic descriptions of the patient. It is shown that context-specific fuzzy membership functions and fuzzy membership functions with two function parameters are helpful to acquire a symbolic description of most clinically relevant medical data.

INTRODUCTION

The data-to-symbol conversion in the medical expert system Cadiag-4 originates in the conversion method developed for Cadiag-2, where symptoms are formalized as fuzzy sets with fuzzy membership functions [1,2]. If a symptom S is a symbolic interpretation of a medical datum x , the membership function $\mu: X \rightarrow [0, 1]$ assigns to every possible $x \in X$ a degree of membership of x in S . Thus, μ expresses the degree of membership to which the symptom S is observed in a patient with a finding x .

METHODS

In many cases a medical datum cannot be interpreted appropriately without consideration of its relationship with another datum. Therefore Cadiag-4 offers the opportunity to define fuzzy membership functions with two function parameters. An example of a medical concept that is defined by two interdependent parameters is shown below.



Here, the estriol level in serum has to be interpreted in combination with the week of gestation.

Fuzzy trends are a special form of fuzzy membership functions with two function parameters supporting the interpretation of a time course of a medical datum. Within Cadiag-4 temporal patterns are formalized as different trends, such as constant, rising, falling, and oscillating trends.

In addition to fuzzy membership functions with two function parameters as described above, context-specific membership functions can be defined. In general, a context can be formalized as an arbitrary logical concept, which is derived from medical data by a preceding data-to-symbol conversion or from other symbols. As a result of the consultation process for a specific patient, the degree of membership of the patient to each context is computed. The final interpretation of the parameter is performed on the context with the maximum degree of membership.

The inference process in Cadiag-4 supports recursive interpretation of medical data. For each cycle of inference the generated symbols can be used as new fuzzy contexts in the following cycle. Therefore, in each cycle of inference medical data are interpreted with updated information about the patient.

DISCUSSION

We believe, that the data-to-symbol conversion, as proposed for Cadiag-4, is flexible enough to include all information necessary for the interpretation of medical data.

Acknowledgments

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References

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